APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/237,356	01/26/1999	SANDEEP CHENNAKESHU	027575-174	7645

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EXAMINER
KUMAR, PANKAJ

ART UNIT	PAPER NUMBER
2631	

DATE MAILED: 10/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/237,356	CHENNAKESHU ET AL.
	Examiner	**Art Unit**	
	Pankaj Kumar	2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 November 2004*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-17,23 and 29* is/are rejected.

7)☒ Claim(s) *18,19,24,25,30 and 31* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
  Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
  Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Response to Arguments

1.   Applicant's arguments with respect to the claims have been considered but are moot in

view of the new ground(s) of rejection.

Response to Amendment

Claim Objections

2.   Claims 14-31 are objected to because of the following informalities:

3.   As per claims 14-19:

a.   It is not clear if "transmitted information" is the same as "transmitted symbol

values". It is suggested that if they are the same that the last line of claim 14 where it

says "yielding transmitted information" be changed to 'yielding the transmitted symbol

values' or else distinctions should be made.

b.   It is not clear if in the last line of claim 14 "the received information signal" is the

same as "M-ary modulated information signal received" from the preamble which is the

same as "M-ary modulated information signal" from the body of the claim. It is

suggested that "the received information signal" be changed to 'the received M-ary

modulated information signal' if they are the same or else distinctions should be made.

4.   Claims 20-31 are similarly objected.

5.   Appropriate correction is required.

Claim Rejections - 35 USC § 102

6.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on
> sale in this country, more than one year prior to the date of application for patent in the United States.

7.   Claims 20-22, 26-28 are rejected under 35 U.S.C. 102(b) as being anticipated by

Bottomley USPN 5,680,419. Here is how the reference teaches the claims:

8.   As per claim 20: In a receiver, a nonlinear maximum-likelihood sequence-estimation

equalizer for demodulating an M-ary modulated information signal received on at least one

receive antenna, the nonlinear maximum-likelihood sequence-estimation equalizer comprising: a

channel coefficient estimator for producing least one channel estimate associated with the M-ary

modulated information signal (Bottomley: BPSK, QPSK; figs. 7, 8: output of 702); a memory for

storing a product look-up table having pre-computed multiplication product values equal to the

product of a set of transmitted symbol values and a complex number, wherein the complex

number depends on the at least one channel estimate (Bottomley col. 2 lines 55-61; col. 6 lines

28-29; col. 8 line 5: A-matrix stored in memory; col. 7 line 37: A matrix is the inverse of the R

matrix which is a multiplication product of values); and a branch metric computer for

determining branch metrics through repeated use of the pre-computed multiplication product

values to demodulate the received information signal yielding transmitted information

(Bottomley fig. 7,8: feedback and thus repeated use of the same elements; col. 1 lines 18-19; col.

9 line 39).

9.   As per claim 21: The nonlinear maximum-likelihood sequence-estimation equalizer of

claim 20 wherein the set of transmitted symbol values comprises all M possible symbol values

(Bottomley col. 1 line 25: transmission; Bottomley: BPSK, QPSK; hence transmitting all 4

possible symbol values for QPSK; col. 6 lines 34-35).

10.   As per claim 22: The nonlinear maximum-likelihood sequence-estimation equalizer of

claim 20 wherein the set of transmitted symbol values comprises a subset of the M possible

symbol values (Bottomley col. 1 line 25: transmission; Bottomley: BPSK, QPSK; hence

transmitting 2 possible symbol values for BPSK which is a subset of 4 possible symbol values

QPSK).

11.   As per claim 26: In a receiver, a nonlinear maximum-likelihood sequence-estimation

equalizer for demodulating an M-ary modulated information signal received on at least one

receive antenna, the nonlinear maximum-likelihood sequence-estimation equalizer comprising:

means for producing least one channel estimate associated with the M-ary modulated

information signal; means for storing a product look-up table having pre-computed

multiplication product values equal to the product of a set of transmitted symbol values and a

complex number, wherein the complex number depends on the at least one channel estimate; and

means for determining branch metrics through repeated use of the pre-computed multiplication

product values to demodulate the received information signal yielding transmitted information.

(discussed above with respect to claim 20)

12.   As per claim 27: The nonlinear maximum-likelihood sequence-estimation equalizer of

claim 26 wherein the set of transmitted symbol values comprises all M possible symbol values.

(discussed above with respect to claim 21)

13.   As per claim 28: The nonlinear maximum-likelihood sequence-estimation equalizer of

claim 26 wherein the set of transmitted symbol values comprises a subset of the M possible

symbol values. (discussed above with respect to claim 22)

Claim Rejections - 35 USC § 103

14.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

15.   Claims 14-17, 23, 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Bottomley USPN 5,680,419 in view of Chennakeshu USPN 5,488,635. Here is how the

references teach the claims:

16.   As per claim 14: In a receiver, a method for demodulating an M-ary modulated

information signal received on at least one receive antenna, said method comprising the steps of:

estimating at least one channel coefficient (Bottomley figs. 7, 8: 702) associated with the M-ary

modulated information signal (Bottomley: BPSK, QPSK) to produce at least one channel

estimate (Bottomley figs. 7, 8: output of 702); pre-computing multiplication product values for a

set of transmitted symbol values and a complex number, wherein the complex number depends

on said at least one channel estimate (Bottomley col. 2 lines 55-61; col. 6 lines 28-29); storing

the pre-computed multiplication product values in a product look-up table (Bottomley col. 8 line

5: A-matrix stored in memory; col. 7 line 37: A matrix is the inverse of the R matrix which is a

multiplication product of values); and determining branch metrics (Bottomley col. 9 line 39) in a

nonlinear (not in Bottomley but would be obvious as explained below) maximum-likelihood

sequence-estimation equalizer (Bottomley col. 1 lines 56-57) through repeated use of the pre

computed multiplication product values to demodulate the received information signal yielding

transmitted information (Bottomley fig. 7,8: feedback and thus repeated use of the same

elements; col. 1 lines 18-19).

17.   Bottomley does not teach that MLSE is nonlinear. Chennakeshu teaches that MLSE is

non-linear (Chennakeshu col. 2 lines 12-15). Thus, it would have been obvious, to one of

ordinary skill in the art, at time the invention was made, to arrive at the nonlinear MLSE as

recited by the instant claims, because the combined teaching of Bottomley with Chennakeshu

suggest nonlinear MLSE as recited by the instant claims. Furthermore, one of ordinary skill in

the art, would have been motivated to combine the teachings of Bottomley with Chennakeshu

because Bottomley suggests MLSE (something broad) in general and Chennakeshu suggests the

beneficial use of nonlinear MLSE such as MLSE being non-linear by nature in the analogous art

of MLSE.

18.   As per claim 15: The method of claim 14 wherein the set of transmitted symbol values

comprises all M possible symbol values (Bottomley col. 1 line 25: transmission; Bottomley:

BPSK, QPSK; hence transmitting all 4 possible symbol values for QPSK; col. 6 lines 34-35).

19.   As per claim 16: The method of claim 14 wherein the set of transmitted symbol values

comprises a subset of the M possible symbol values (Bottomley col. 1 line 25: transmission;

Bottomley: BPSK, QPSK; hence transmitting 2 possible symbol values for BPSK which is a

subset of 4 possible symbol values QPSK).

20.   As per claim 17: The method of claim 14 wherein the complex number comprises the channel estimate (Chennakeshu col. 10 lines 1-7: channel estimate h is comprised of the complex conjugate S*).

21.   As per claim 23: The nonlinear maximum-likelihood sequence-estimation equalizer of claim 20 wherein the complex number comprises the channel estimate (not in Bottomley but would be obvious as explained below). Bottomley does not teach that complex number comprises the channel estimate. Chennakeshu teaches in col. 10 lines 1-7 that channel estimate h is comprised of the complex conjugate S*. Thus, it would have been obvious, to one of ordinary skill in the art, at time the invention was made, to arrive at the complex number comprises the channel estimate as recited by the instant claims, because the combined teaching of Bottomley with Chennakeshu suggest complex number comprises the channel estimate as recited by the instant claims. Furthermore, one of ordinary skill in the art, would have been motivated to combine the teachings of Bottomley with Chennakeshu because Bottomley suggests complex values (something broad) in general and Chennakeshu suggests the beneficial use of using complex values in the channel estimate such as in order to find the solution for the channel impulse response as stated in Chennakeshu col. 9 line 58 to col. 10 line 7 in the analogous art of channel estimate.

22.   As per claim 29: The nonlinear maximum-likelihood sequence-estimation equalizer of claim 26 wherein the complex number comprises the channel estimate. (discussed above with respect to claim 23)

Allowable Subject Matter

23.   Claims 18, 19, 24, 25, 30, 31 are objected to as being dependent upon a rejected base

claim, but would be allowable if rewritten in independent form including all of the limitations of

the base claim and any intervening claims and rewritten to overcome the objections from the

claim objections section.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Pankaj Kumar whose telephone number is (571) 272-3011. The

examiner can normally be reached on Mon, Tues, Thurs and Fri after 8AM to after 6:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Mohammad H. Ghayour can be reached on (571) 272-3021. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Pankaj Kumar
Patent Examiner
Art Unit 2631

PK